

What is claimed is:

1. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

when the battery is discharged, the control unit decreases an air-conditioning capacity of the air conditioning unit, as compared with a case where the battery is charged.

2. The air conditioner according to claim 1, wherein:

when an electrical power amount discharged from the battery is equal to or larger than a predetermined value, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the electrical power amount discharged from the battery is smaller

than the predetermined value.

3. The air conditioner according to claim 1, wherein:

when a running load of the vehicle is equal to or larger than a predetermined value, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the running load of the vehicle is smaller than the predetermined value.

4. The air conditioner according to claim 1, wherein the control unit controls the air-conditioning capacity of the air conditioning unit, based on a power generation state of the power generator.

5. The air conditioner according to claim 1, wherein:

when the vehicle is in an acceleration state, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the vehicle is in a deceleration state.

6. The air conditioner according to claim 1, wherein:

when a power generation efficiency due to the engine is equal to or lower than a predetermined efficiency, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the power generation efficiency due to the engine is higher than the predetermined efficiency.

7. The air conditioner according to claim 1, wherein:

the air conditioning unit includes a vapor-compression refrigerant cycle that is operated in one of an economy mode where a capacity of the vapor-compression refrigerant cycle is restricted to be lower than a predetermined level, and a full mode that releases the economy mode; and

the control unit forbids to decrease the air-conditioning capacity of the air conditioning unit, in any one mode of a large air-conditioning load mode where an air conditioning load is larger than a predetermined load, a defroster mode where air is blown toward a vehicle windshield, and the full mode.

8. The air conditioner according to claim 1, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the control unit sets an electrical power used for the air conditioning unit at a predetermined value lower than the air-conditioning necessary electrical power, so that the air-conditioning capacity of the air conditioning unit is decreased.

9. The air conditioner according to claim 1, wherein:

the air conditioning unit includes a refrigerant cycle

system in which refrigerant circulates; and

the refrigerant cycle system includes an electrical compressor, operated using electrical power supplied from the electrical motor, for compressing refrigerant.

10. The air conditioner according to claim 1, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the charging-starting target value is set larger as the air-conditioning necessary electrical power in a vehicle running becomes larger.

11. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes

equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

when a running load of the vehicle is equal to or larger than a predetermined value, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the running load of the vehicle is smaller than the predetermined value.

12. The air conditioner according to claim 11, wherein:

the air conditioning unit includes a vapor-compression refrigerant cycle that is operated in one of an economy mode where a capacity of the vapor-compression refrigerant cycle is restricted to be lower than a predetermined level, and a full mode that releases the economy mode; and

the control unit forbids to decrease the air-conditioning capacity of the air conditioning unit, in any one mode of a large air-conditioning load mode where an air conditioning load is larger than a predetermined load, a defroster mode where air is blown toward a vehicle windshield, and the full mode.

13. The air conditioner according to claim 11, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the control unit sets an electrical power used for the air conditioning unit at a predetermined value lower than the air-conditioning necessary electrical power, so that the air-conditioning capacity of the air conditioning unit is decreased.

14. The air conditioner according to claim 11, wherein:
the air conditioning unit includes a refrigerant cycle system in which refrigerant circulates; and

the refrigerant cycle system includes an electrical compressor, operated using electrical power supplied from the electrical motor, for compressing refrigerant.

15. The air conditioner according to claim 11, wherein:
the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the charging-starting target value is set larger as the air-conditioning necessary electrical power in a vehicle running becomes larger.

16. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate

electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

the control unit controls an air-conditioning capacity of the air conditioning unit, based on a power generation state of the power generator.

17. The air conditioner according to claim 16, wherein:

the air conditioning unit includes a vapor-compression refrigerant cycle that is operated in one of an economy mode where a capacity of the vapor-compression refrigerant cycle is restricted to be lower than a predetermined level, and a full mode that releases the economy mode; and

the control unit forbids to decrease the air-conditioning capacity of the air conditioning unit, in any one mode of a large air-conditioning load mode where an air conditioning load is larger than a predetermined load, a defroster mode where air is blown toward a vehicle windshield, and the full mode.

18. The air conditioner according to claim 16, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the control unit sets an electrical power used for the air conditioning unit at a predetermined value lower than the air-conditioning necessary electrical power, so that the air-conditioning capacity of the air conditioning unit is decreased.

19. The air conditioner according to claim 16, wherein:

the air conditioning unit includes a refrigerant cycle system in which refrigerant circulates; and

the refrigerant cycle system includes an electrical compressor, operated using electrical power supplied from the electrical motor, for compressing refrigerant.

20. The air conditioner according to claim 16, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the charging-starting target value is set larger as the air-conditioning necessary electrical power in a vehicle running becomes larger.

21. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

when the vehicle is in an acceleration state, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the vehicle is in a deceleration state.

22. The air conditioner according to claim 21, wherein:

the air conditioning unit includes a vapor-compression refrigerant cycle that is operated in one of an economy mode where a capacity of the vapor-compression refrigerant cycle is restricted to be lower than a predetermined level, and a full

mode that releases the economy mode; and

the control unit forbids to decrease the air-conditioning capacity of the air conditioning unit, in any one mode of a large air-conditioning load mode where an air conditioning load is larger than a predetermined load, a defroster mode where air is blown toward a vehicle windshield, and the full mode.

23. The air conditioner according to claim 21, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the control unit sets an electrical power used for the air conditioning unit at a predetermined value lower than the air-conditioning necessary electrical power, so that the air-conditioning capacity of the air conditioning unit is decreased.

24. The air conditioner according to claim 21, wherein:

the air conditioning unit includes a refrigerant cycle system in which refrigerant circulates; and

the refrigerant cycle system includes an electrical compressor, operated using electrical power supplied from the electrical motor, for compressing refrigerant.

25. The air conditioner according to claim 21, wherein:

the control unit calculates an air-conditioning necessary electrical power, required for the air conditioning unit for adjusting a temperature in the passenger compartment at a set temperature; and

the charging-starting target value is set larger as the air-conditioning necessary electrical power in a vehicle running becomes larger.

26. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

when an electrical power amount discharged from the battery is equal to or larger than a predetermined value, the control unit decreases the air-conditioning capacity of the

air conditioning unit, as compared with a case where the electrical power amount discharged from the battery is smaller than the predetermined value.

27. An air conditioner for a hybrid vehicle, the hybrid vehicle having an engine for running the vehicle, an electrical motor for supplementary running the vehicle, a battery for supplying electrical power to the electrical motor, and a power generator driven by the engine to generate electrical power and to charge the battery, the air conditioner comprising:

an air conditioning unit, to which electrical power from the battery is supplied, for performing air-conditioning operation in a passenger compartment of the vehicle; and

a control unit for controlling operation of the air conditioning unit, wherein:

when a residual charging degree of the battery becomes equal to or lower than a charging-starting target value, the electrical motor is driven by the engine to charge the battery; and

when a power generation efficiency due to the engine is equal to or lower than a predetermined efficiency, the control unit decreases the air-conditioning capacity of the air conditioning unit, as compared with a case where the power generation efficiency due to the engine is higher than the predetermined efficiency.